

midade, onde a pubescencia torna-se mais longa e densa. Azas inferiores infuscadas.

Comprimento 9,5 mm; largura humeral 2 mm.

Holotypo ♂ no Instituto de Experimentação Agrícola do Rio de Janeiro.

Localidade-tipo: Espirito Santo, Faz. Jerusa'em, 20.XI.1914, J. F. Zikán coll.

Conservo para esta especie o nome escolhido pelo saudoso Julius Melzer, pois que o exemplar encontra-se etiquetado da seguinte maneira: *Antodice abstrusa* Melz. Typus. Infelizmente parece não ter sido descripta.

Descrições mais pormenorizadas, illustrações e discussão taxonomica, destas tres especies, apparecerão opportunamente na «Revisão da subfamilia Aerenicinae», ora em elaboração.

Aproveito o ensejo para agradecer a Frei Thomaz Borgmeier e ao Snr. Dario Mendes, do Instituto de Experimentação Agrícola do Rio de Janeiro, e ao Dr. Paulino Recch, de Amparo, a permissão para o exame do material aqui estudado.

Abstract

The author describes three new species of *Antodice*: *A. neivai*, *A. mendesi* and *A. abstrusa*. Full descriptions, illustrations and taxonomic discussion will eventually appear in «The Revision of the subfamily Aerenicinae», in preparation.

The biology of the fungus-growing ants. Part VI. Key to *Cyphomyrmex*, new *Attini* and a new guest ant¹

by NEAL A. WEBER, University of North Dakota

(With 16 figures)

The following key serves to bring together for the first time descriptions of all known forms of *Cyphomyrmex*. No key to *Cyphomyrmex* has appeared since that of Mayr in 1887 (Verh. Zool. bot. Gesellsch. Wien, 1: 555-557) to the five species then known. One of these has been generally considered a synonym for many years. In the present key 21 species, 18 subspecies and one variety are included. Also listed are two doubtful varieties and a species known only

¹) This paper is a contribution to the memorial volume of the Revista de Entomologia, published in honor of Professor Dr. Arthur Neiva.

by the male caste. Of the 43 forms, four species and two subspecies are new to science and described for the first time.

The key is admittedly imperfect since specimens of some of the species have not been available for study; a few of these species are represented only by single type specimens in European collections. The bringing together of all forms, however, may justify it.

There has been much confusion over several of the *Cyphomyrmex* forms. This may be traced largely to the incomplete descriptions of the genotype, *rimosus* by Spinola (1851) and of *minutus* by Mayr (1862). Both descriptions evidently applied to an ant without strong sculpturing. Subsequently myrmecologists have applied one or the other name to the common *Cyphomyrmex* distributed generally in the West Indies and Central and South American countries of the Caribbean. Mayr's specimen came from Cuba. Both Forel and Wheeler believed Mayr's *minutus* to be a synonym of *rimosus* though frequently they recorded the West Indian *Cyphomyrmex* as *rimosus* ssp. or var. *minutus*. All specimens which I have collected in Cuba and many other West Indian islands belong to the common, widely distributed mainland form and answer to both original descriptions. Spinola's specimens came from Pará, Brazil. In this paper *minutus* is considered a synonym of *rimosus* whose type locality is Pará, Brazil.

The validity of several forms based on color may be questioned, considering the variability of this characteristic. Immature *Cyphomyrmex* are always pale and darken gradually to the adult color or so that in any nest there is apt to be much variation among the workers. Within a colony and between neighboring colonies, furthermore, workers show appreciable differences in morphology, particularly in thoracic spinulation.

The new fungus growing ants from Panama and Colombia are from collections which I made June-August, 1938. Only the new *Cyphomyrmex* from Colombia are here described. The remainder are from Barro Colorado Island, Panama Canal Zone, and belong to the genera *Cyphomyrmex*, *Mycocepurus*, *Apterostigma* and *Trachymyrmex*. The description of a new guest ant, *Megalomyrmex* (*Cepobroticus*) *wheeleri*, which lives in the nest of *Cyphomyrmex costatus* Mann is also included. This is the second species of ant

known to live in the nest of a fungus-grower and feed upon the fungus.

The biology of the Barro Colorado Island fungus-growers will be covered in a later publication.

Genus *Cyphomyrmex* Mayr

Key to the workers

1. Occipital angles lamellate, thorax without tubercles or spines . . . subg. *Cyphomannia* Weber (sole species *laevigatus* Weber, Bolivia)
- Occipital angles auriculate or tuberculate, thorax with spines, tubercles or ridges subg. *Cyphomyrmex* Mayr (genotype *rimosus* Spinola)
2. Thorax in profile feebly sinuous, with low lateral pronotal and epinotal tubercles, postpetiole 2 1/2 times broader than long (after Santschi) (Argentina) *bruchi* Santschi
- Thorax with distinct spines, tubercles, or ridges 3
3. (2) Gaster with a pair of longitudinal mid-dorsal carinae 4
- Gaster not carinate mid-dorsally 7
4. (3) Thorax strongly tuberculate 5
- Thorax carinate, not tuberculate 6
5. (4) Occipital angles long, slender, auriculate; the single median pronotal tubercle well developed, first pair of lateral thoracic tubercles highest, about 7 mandibular teeth, 3.7-3.8 mm. (Brazil) . . . *auritus* Mayr
- Occipital angles moderately developed, rounded, thoracic tubercles moderately developed, 2.3-2.4 mm. (after Mayr) (Brazil) . . . *strigatus* Mayr
6. (4) Thorax length 0.8 mm., mesoepinotal impression a shallow, rounded impression, color dark brown. (Rio Porce, Colombia, 3300 ft., N. A. Weber) *colombianus*, sp. nov.
- Thorax length 0.7 mm., mesoepinotal impression a more U-shaped notch, color ferruginous (Honduras, Panama) *costatus* Mann (Figs. 1, 2)
7. (3) Antennal scrobe becoming gradually shallower posteriorly, terminating in front of the rounded occipital angles at a point level with the posterior border of the eyes; pronotum posteriorly with three tubercles of which the middle is the smallest, mesonotum moderately rounded, disc-shaped with four indistinct weak tubercles; epinotum with two short spines; postpetiole flattened dorsally and not impressed (after Mayr) (Cayenne) *conformis* Mayr
- Combinations of characters not as above 8
8. (7) Anterior clypeal margin with two very small teeth, frontal area with fine, short rugae, second to fourth funicular joints somewhat longer than broad, pronotum angulate on each side, without median tubercles (after Mayr). (Colombia) . . . *kirbyi* Mayr
- Combination of characters not as above 9
9. (8) Occipital angles produced as acute spines, all thoracic spines

- acute, epinotum acutely bicarinate, postpetiole strongly bituberculate above, all funicular joints markedly longer than broad, head and thorax rugulose. (Jamaica) *foxi* E. André
- Combination of characters not as above, usually not markedly spinose 10
10. (9) Mandibles 5-6 toothed, pronotum smooth, mesonotum with two rounded horns, petiole more than twice as broad as long (broader than in *rimosus*), squamate hairs of head and thorax somewhat finer and weaker than in *rimosus* (after Forel). (Rio de Janeiro) *bicornis* Forel
- Combination of characters otherwise 11
11. (10) Mandibles 5-toothed 12
- Mandibles with 6 or more teeth 19
12. (11) Antennal scapes reaching occipital angles, the latter not markedly produced, funicular joints 2-8 slightly broader than long. Length 2-2.5 mm., (thorax 0.9 mm.), frontal lobes large, petiolar node with two spines directed upward and backwards (Texas) . . . *wheeleri* Forel
- Petiolar node without spines 13
13. (12) Antennal scapes slightly exceeding occipital angles, termination of the antennal scrobe at the occipital angles broad and truncate. thoracic tubercles and ridges much reduced, epinotum with a pair of distinct, compressed teeth, funicular joints 2-7 slightly broader than long, postpetiole with a complete dorsal longitudinal impression (after Wheeler) (Mexico) *flavidus* Pergande
- Combination of characters not as above 14
14. (13) Antennal scrobe extending not quite to the occipital tubercles and with a slight carina in front of the eye extending from the outer margin of the eye diagonally and medially close to the medial border of the groove so as to nearly bifurcate it, occipital angles produced as distinct, acute spines, paired carinae of vertex acute. Pronotum with a medial pair of low tubercles and a much larger lateral pair; medial thoracic (first mesonotal) spines largest of thorax, posterior pair low but acute; epinotum rounded, with feeble lateral carinae; postpetiole deeply impressed above, and forming a pair of tubercles projecting behind; medial gastric impression faint, color dark ferruginous with appendages paler. Length 2.3 mm. (thorax 1.2 mm.). (Barro Colorado Island, Panama, N. A. Weber) *acutus* sp. nov.
- Combination of characters not as above 15
15. (14) Antennal scapes exceeding the sharp tubercles of the occipital angles by a distance greater than their distal diameter, sides of head back of eyes with an acute tubercle, antennal scrobe extending to base of occipital spine and margined medially by sharp frontal carinae which fail to reach occipital spines by a distance about equal to the length of the spines; vertex of head with the usual paired carinae expanded as compressed tubercles; median pair of pronotal tubercles distinct, lateral pair larger and acute, median thoracic (first mesonotal) pair highest of thorax, posterior pair of tubercles reduced to slight, rounded carinae; epinotum with a pair of distinct carinae; postpetiole medially impressed above and pro-

- jecting backwards as two feeble tubercles; gaster dorso-medially very feebly impressed at anterior margin; hairs appressed to body and narrow, not squamate. Color dull ferruginous, appendages paler. Length 2.5-2.6 mm (thorax 1.2-1.3 mm.) (Sta. Helena, W. M. Mann) *vorticis* sp. nov.
- Combination of characters not as above 16
16. (15) Frontal carinae posterior to the small frontal lobes parallel, antennal scapes clavate, exceeding occipital angles by about $\frac{1}{3}$ their length, clypeus produced as a convex lobe with a median notch, occipital angles shorter than their bases; median pronotal tubercles absent, thorax with two pair of low tubercles; epinotum smoothly rounded, not carinate or dentate, postpetiole broader than long, broadly impressed dorsally, feebly bituberculate behind; gaster faintly marginate laterally, color dark brown, appendages paler. Length 2.5 mm. (thorax 1.3 mm.) (Rio Porco, Colombia, 3400 ft., N. A. Weber) *longiscapus* sp. nov.
- Frontal carinae posterior to frontal lobes not parallel, the lobes much larger 17
17. (16) Frontal lobes large, pronotum with a single, small, sharp, median pronotal tubercle and a lateral pair of much higher and rounded tubercles, the two pairs of mesonotal tubercles well developed and more massive than the lateral pronotal tubercles, mesoepinotal impression deep, bordered by distinct epinotal gibbositities, epinotal tubercles faint (after Forel) (Brazil) . . . *olitor* Forel*
- Promesonotal tubercles weaker, obtusely rounded, low and broad, inferior pronotal spine long, pointed, epinotum evenly rounded, not tuberculate, petiole and postpetiole broader than long (after Forel) (Brazil) *olitor* ssp. *lecta* Forel
- Combination of characters, otherwise, usually with two median pronotal tubercles or none 18
18. (17) Frontal lobes large, half or more as long as the head (excluding occipital tubercles), thoracic spinulation variable. Fungus gardens on insect feces, the fungus in form of compact, irregularly polygonal bodies about one millimeter in diameter and without hyphae. Distribution of the tribe *rimosus* Spinola
- Ridges and tubercles of thorax low and rounded 18a
- At least some of thoracic ridges and tubercles sharp and distinct 18i
- 18a Occipital angles low and rounded, not produced as auriculate lobes, no one set of thoracic tubercles prominent, epinotum rounded and without tubercles, postpetiolar length somewhat over half its width, postpetiolar dorsum broadly impressed posteriorly, dorsum of gaster with a feeble impression antero-medially, color variable, ferruginous to dark brown *rimosus* ssp. *rimosus* Spinola (Figs. 3, 10)
- Combination of characters not as above 18b
- 18b Forms based on color largely 18c
- Forms based on color and structure 18e

*) *C. olitor* is probably a subspecies of *rimosus*.

- 18c Color «clear yellow, with the head, excepting the mandibles and borders of frontal lobes, and the first gastric segment, except its posterior border, brown. Length 1.4-1.5 mm.» (Wheeler) (Haiti) ssp. *flavescens* n. nom.*
- Color brown 18d
- 18d Color uniformly brown, epinotum smooth, tuberculation variable (Santschi, 1931, figs. 1 and 2) (Brazil, Argentina) . . . ssp. *fuscus* Emery
- Scapes surpassing occipital angles by fully their distal diameter, pronotum with paired median and lateral blunt tubercles, mesonotum with paired gibbosities, postpetiole impressed dorsally only posteriorly, dark brown (after Wheeler) (Texas) var. *comalensis* Wheeler
- 18e Occipital tubercles absent, lateral pronotal tubercles massive and largest, epinotum feebly denticulate; black, appendages brown; 2.3-2.5 mm. Female 3 mm., pronotum with two obtuse teeth. Male 2.7-3 mm., frontal area terminates at the occiput in a tubercle or promontory, pronotum with a strong tooth (after Forel) (Santa Marta, Colombia) ssp. *atratus* Forel
- Combination of characters not as above 18f
- 18f (18e) Epinotum with a large and distinct tubercle on each side, mesoepinotal impression acute, only the pronotal of the thoracic tubercles distinct, occipital angles not produced, gaster carinate on sides. Female: Antennal scape stout, not surpassing posterior angle of head, epinotum clearly dentate, postpetiole about three times as broad as long. Male: Occipital angles dentate, occiput feebly concave, frontal lobes large, with lateral margin obtusely angulate, mandibles 5-6 toothed, lateral teeth of the pronotum as large as those of the epinotum (after Bruch and Santschi) (Argentina) ssp. *pencosensis* Forel
- Combination of characters otherwise 18g
- 18g (f) Thorax length 1.0 mm, occipital angles produced as distinct tubercles, median frontal paired tubercles distinct and with conspicuous narrow-squamate hairs, epinotal declivity angulate, postpetiole above with a distinct impression continuing backwards over anterior part of gaster and devoid of hairs (Orinoco Delta, Venezuela) ssp. *cariapensis* Weber (Figs. 6, 8, 9)
- Thorax length less than 0.9 mm., occipital angles lower, median paired pronotal tubercles lower 18h
- 18h (18g) Thorax length about 0.86 mm., antennal scapes exceeding occiput by at least their distal diameter, head and gaster darker than remainder of body, petiole about 4/5 broader than long, postpetiole about 2/5 broader than petiole and slightly over 1/2 broader than long (Orinoco River, Venezuela) ssp. *venezuelensis* Weber. (Fig. 5)

*) *Cyphomymex* ssp. *rimosus flavescens* n. nomen, *Cyphomymex rimosus minutus* Mayr var. *flavidus* Wheeler, Bull. Mus. Comp. Zool. 1936, 80:204, nec *C. flavidus* Pergande 1895. This is the form to which I refer in Part IV (Rev. de Ent., 1938, 9:189)

- Thorax length 0.7-0.75 mm (body length 1.3-1.6 mm.), antennal scapes exceeding occiput by $1/2-3/4$ their distal diameter, uniformly light ferruginous, basal epinotal surface with paired carinae convex in profile, declivous surface with a pair of acute tubercles, postpetiole $1/3-1/2$ broader than long, broadly and triangularly impressed above, gaster impressed above anteriorly, sides carinate (Barro Colorado Island, Panama Canal Zone, N. A. Weber) ssp. *breviscapus* ssp. nov.
- 18i (18) Body hairs simple, hooked. Bolivia ssp. *hamulatus* Weber
- Body hairs narrow-squamate, appressed 18j
- 18j (18i) Female 2.4 mm. Worker — occipital angles pronounced, excavated to form nearly complete grooves for the antennal scapes, which surpass the angles little if at all, pronotal tubercles dentiform, basal surface of epinotum with two distinct teeth, postpetiole strongly notched above posteriorly, the sides prolonged as dentiform cones (after Wheeler). (Mexico) ssp. *dentatus* Forel
- Occipital angles not pronounced or female much larger . . 18k
- 18k (18j) Female 3.7 mm., occipital angles auriculate, antennal scrobes with a distinct acute ridge in front of eyes, distinct tooth posterior to eyes on sides, postpetiole from above transversely rectangular, with truncate anterior angles, deeply incised medially; ferruginous. Worker 2.5 mm., thoracic spinulation pronounced, the median pair of spines highest, epinotal teeth very faintly indicated, postpetiole slightly over $1/2$ broader than long, postero-medially deeply impressed, gaster medially impressed. Male nearly 3 mm., superior occipital teeth short and acute, superior pronotal pair blunt and slender, epinotum with a pair of broad, laterally compressed projections or prominent ridges (after Forel). (Panama) ssp. *salvini* Forel
- Occipital angles not produced 18l
- 18l (18k) Postpetiole less than $1/2$ broader than long. Female 2.2 mm. (Trinidad, Panama) ssp. *trinitatis* Weber (Fig. 4)
- Postpetiole more than $1/2$ broader than long, postpetiole more deeply impressed. (Brazil) ssp. *transversus* Emery *
- 19 (11) Antennal scapes barely or not quite reaching tips of the auriculate occipital angles, mandibles 6-8 toothed, thorax with one very prominent medial pair of spines, epinotum evenly rounded. (Brazil, Bolivia, British Guiana, Trinidad) . . *bigibbosus* Emery

*) Forel and Wheeler agreed that the ssp. *olindanus* Forel was a synonym of *transversus*. According to Forel the female is 3.4 mm., with very prominent occipital angles and a strongly bidentate epinotum. — Forms of *rimosus* not in the Key :

C. rimosus v. *arnoldi* Aguayo is described as differing from the v. *minuta* (= ssp. *rimosus*) worker in having «a remarkable accentuation of the height of the ridges and tubercles of the head, thorax and epinotum. The tubercles of the thorax are long and pointed, instead of short and blunt. The area between the tubercles of the mesothorax is more depressed and narrower. The ridges and tubercles of the epinotum are higher.» (Jamaica). Could this be *C. foxi*?

- Occipital angles low and rounded; posterior margin of postpetiole deeply emarginate medially, leaving a distinct tubercle on each side. (British Guiana) *bigibbosus* ssp. *tumulus* Weber (Figs. 7, 11, 12)
- Occipital angles well developed and acutely pointed, posterior postpetiolar margin feebly bituberculate 19a
- 19a Postpetiole as long as broad. (Amazon to Bolivia, British Guiana and Trinidad) *bigibbosus* ssp. *bigibbosus* Emery
- Postpetiole broader than long 19b
- 19b Antennal scapes extending to the tips of the occipital lobes; petiole of the female rectangular, slightly longer than wide with straight sides. (British Guiana) *bigibbosus* ssp. *faunulus* Wheeler
- Antennal scapes not reaching tips of occipital lobes; petiole of the female distinctly broader than long, the sides produced as two large lobes anteriorly, the dorsum convex and with two feeble tubercles. (Bolivia) . . . *bigibbosus* ssp. *petiolatus* Weber
- Combination of characters not as above 20
- 20. (19) Antennal scapes slightly surpassing occipital angles, the latter extended a distance equal to their width beyond posterior border of head; all funicular joints longer than broad, frontal lobes small and narrow, pronotum with a single median tubercle and two larger lateral tubercles, mesonotum with four laterally compressed tubercles, the anterior pair being the largest of the thorax, epinotal angles in form of two blunt teeth which continue forward as carinae, postpetiole nearly as long as broad (after Wheeler) (Brazil) *paniscus* Wheeler
- Occipital angles not greatly prolonged 21
- 21. (20) Antennal scapes surpassing occiput by their maximum thickness, funicular joints slightly longer than broad, mesonotal tubercles well developed, epinotum denticulate, petiole rectangular, about 1/4 broader than long, postpetiole cupuliform (after Santschi). Argentina *daguerrei* Santschi
- Less robust, mesonotal tubercles weaker, funicular joints 2-5 slenderer (after Santschi). (Brazil) *morschi* Emery

New Attini

Cyphomyrmex colombianus, sp. nov.

This small species resembles *C. costatus* Mann but is slightly larger, noticeably darker, and has a shallower mesoepinotal impression, among other differences.

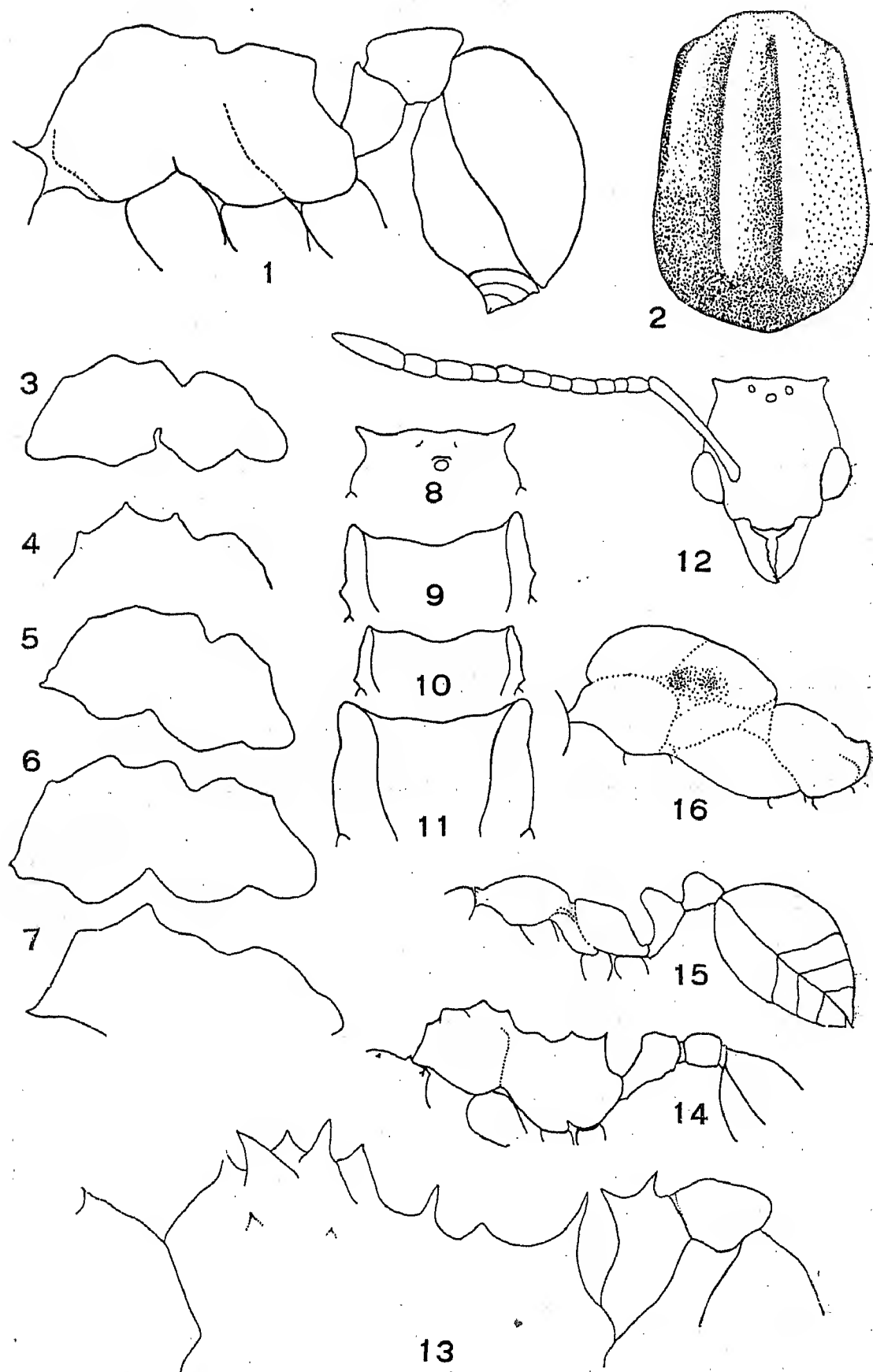
C. rimosus v. *major* Forel. Worker 2.7-2.8 mm. Thoracic spinulation pronounced, occipital angles longer than in the typical *rimosus*, color dark (after Forel). (Guatemala and Brazil).

C. championi Forel. Male 3.5 mm., occipital angle with a pointed spine curved forwards and distinctly longer than broad at the base; antennal scapes surpassing occiput by 1/3 their length, with a fusiform enlargement of the distal half; pronotum armed with a triangular, pointed spine, a little longer than broad at the base; hairs squamate, gaster sub-opaque, blackish-brown (after Forel). (Panama).

The type locality is El Hormiguero Mine, a gold mine about a score of years old, on the slopes of the Cordillera Central bordering the Rio Porce, Colombia where I found this species upon three days at elevations of 3200 to 3000 feet above sea level. A worker was found in a small clearing under several orange trees where a hut stood for a time. It resembled *C. rimosus* in slow-moving habit and inconspicuousness. The following day, July 18, 1938, two dealate females were taken near each other on the sandy clay bench of El Hormiguero Creek near its junction with the Rio Porce. One was starting her colony independently and had constructed on a crooked rootlet a fungus garden about 10 mm. long in a cell barely large enough to accommodate it. The fungus garden was of the fluffy, typical Attine type, having a mycelium with bromatia, the whole garden being light-brown internally, grayish externally.

The third record is of a dealate female taken August 1 with her fungus garden. She, too, was starting a colony independently. The nest was in second-growth bush in the slanting side of a depression in the damp clay. It was situated a distance of 45 mm. into the bank, was 8 mm. wide \times 10 mm. high and was suspended from a rootlet. The fungus resembled that of the average Attine, being composed of a scanty mycelium and several loose bromatia. The substrate was composed of part of a caterpillar feces and plant remains, mostly pieces of a small flower. Particularly significant was the fact that the plant remains were fresh and green, proving that the female leaves her nest to forage for fresh substrate. Such a habit seems not to have been observed before and it has been supposed that the Attine female imprisons herself until the first brood appears. There was no brood in the garden.

Fig. 1. *Cyphomyrmex costatus* Mann, worker. — Fig. 2 *Idem*, gaster of worker from above. — Fig. 3. *Cyphomyrmex rimosus rimosus* Spinola, worker thorax, Trinidad. — Fig. 4. *C. rimosus trinitatis* Weber, worker thorax, cotype. — Fig. 5. *C. rimosus venezuelensis* Weber, worker thorax, cotype. — Fig. 7. *C. bigibbosus tumulus* Weber, worker thorax, cotype. — Fig. 8. *C. rimosus curiupensis* Weber, male, cotype, outline of occipital region. — Fig. 9 *Idem*, worker, cotype. — Fig. 10 *C. rimosus rimosus* Spinola, worker, Trinidad, outline of occipital region. — Fig. 11. *C. bigibbosus tumulus* Weber, worker, cotype, outline of occipital region. — Fig. 12. *Idem*, male, cotype head and antenna. — Fig. 13. *Mycocepurus tardus* n., sp. worker. — Fig. 14. *Myrmicocrypta ednaella* Mann, worker (Canal Zone). — Fig. 15. *Megalomyrmex (Cepobroticus) wheeleri* n. sp., worker. — Fig. 16. *Idem*, thorax of female. (N. A. Weber del.)



Explanation of figures see on page 414.

Mycocepurus tardus, sp. nov. (Fig. 13)

Worker. — Length. 1.9 mm., of thorax (including epinotum) 0.9 mm. Head, excluding mandibles, barely longer than broad, occipital margin impressed to form a broad, obtuse angle, occipital angle in the form of an acute, short spine directed forward, sides sub-parallel, converging slightly posteriorly, eyes moderately convex, situated a distance about equal to twice their distal diameters from the mandibular insertions, frontal lobes small, rounded, continued to a level about equal to the anterior margin of the eyes as feeble carinae, median paired carinae of the occiput very short, projecting as a denticle in profile, the anterior clypeal margin feebly convex and slightly sinuate, mandibles with five coarse teeth. Highest part of thorax surmounted by a ring of eight spines of which the antero-lateral pair are distinctly highest and the next posterior pair second highest, in the middle of the circle a pair of lower but distinct tubercles and on the sides of the pronotum below the largest spines a tiny spine or acute tubercle; meso-epinotal region with a high, slender spine on each side, basal surface of epinotum on either side with a low, compressed tubercle in front and a pair of long, slender and acute spines posteriorly. Petiole from above squarish, the anterior corners surmounted by vertical spines, the posterior corner by longer spines directed slightly backwards, ventral margin in side view convex. Postpetiole from above distinctly broader than long, three times as broad as the dorsum of the petiolar node, posterior corners rounded, sides conveying to the petiole, posterior margin bituberculate. Gaster carinate laterally. Legs moderately long and slender.

Opaque, finely reticulate, becoming somewhat more coarsely reticulate-vermiculate on the head. Mandibles finely striate.

Pilosity of sparse, curved hairs becoming more numerous and reclinate on the gaster.

Reddish brown, appendages paler.

Cotypes: five workers taken June 12 and June 14, 1938 on Barro Colorado Island, Panama Canal Zone, by myself. The two June 12 workers belonged to the same nest and had thrown up a crater of fine clay grains from a tiny nest opening. Two of the June 14 workers belonged to a colony which had erected a tiny, irregular cone-like crater of fine clay pellets 23 mm. high and 26 mm. in diameter.

This species may be readily separated from *M. smithi* Forel of the Caribbean area, from *smithi* var. *borinquenensis* Wheeler of Puerto Rico and Cuba, from *smithi* ssp. *trinidadensis* Weber of Trinidad, and from *M. boliviana* Weber of Bolivia by the well-developed pair of tubercles in the circlet of thoracic spines and darker color. *M. smithi* occurs a few miles away from Barro Colorado at Gatun in the Canal Zone, where I found it June 17.

Myrmicocrypta ednaella Mann (Fig. 14)

This species was found to be widely distributed over Barro Colorado Island, Panama Canal Zone. Workers were briefly compared in the U. S. National Museum with the cotypes of *ednaella* and there were found to be slight differences. More extensive ecological and morphological study is necessary before determining whether the Panama form is distinct or not.

Apterostigma tramitis, sp. nov.

Worker. — Length 2.5-2.8 mm., of thorax (including epinotum) 1.3 mm. Head, excluding mandibles two-fifths longer than broad in front of eyes, occipital margin convex, with a short neck, sides subparallel, eyes convex, situated a distance distinctly farther from the mandibular insertions than their diameters, frontal lobes moderate, with rounded lateral angles slightly reflexed, frontal carinae indistinct and very short, antennal scrobes bordered laterally by faint carinae medial to eyes and curving around eyes, anterior clypeal margin convex, angulate medially, antennal scapes exceeding occiput by fully their distal diameters, funicular joints 2-9 markedly broader than long, terminal joint short, equal in length to the preceding 4 taken together, mandibles 10-11 toothed. Anterior pronotal margin raised as a slight, irregular carina, paired longitudinal carinae of the thorax and epinotum feeble, thorax in profile without distinct projections. Petiole in profile short and high, over 1/4 longer from apex of tooth to postero-ventral margin than high through node, ventrum nearly plane, dorsum rounded. Post-petiole from above somewhat triangular with convex sides converging anteriorly, fully twice as broad as the petiole, one-fifth broader than long. Gaster feebly carinate on the sides. Legs somewhat short and thick.

Opaque finely granulose, mandibles densely and finely striate-punctate.

Pilosity of long, acute and mostly reclinate dark hairs among a more abundant, finer, paler and more reclinate pilosity, both most abundant on the gaster.

Grayish ferruginous, appendages ferruginous.

Female. — Length 2.9 mm., of thorax (including epinotum) 1.4 mm. Similar to the worker with the usual differences. Head, excluding mandibles, one-third longer than broad, occipital margin smoothly convex except for a faint median impression, neck short, sides of head subparallel, anterior clypeal margin convex, funicular joints 2-9 strongly transverse. Anterior pronotal margin produced as a slight, rounded carina highest on either side, epinotum with a feeble carina on either side. Postpetiole fully twice as broad as the petiole, about one-fifth broader than long, somewhat triangular with rounded sides. Gaster carinate on the sides. Legs somewhat short and thick. Dark ferruginous, appendages somewhat paler.

Cotypes: 17 workers and one (holotype) queen constituting a colony taken August 13, 1938 on Barro Colorado Island, Panama Canal Zone, by myself. There were, in addition, two female pupae, eleven worker pupae, larvae and eggs. The colony nested in the soil close to nests of *Myrmicocrypta ednaella* Mann and *Trachymyrmex cornetzi* Forel ssp. *gaton* Weber.

This species is close to *A. mayri* Forel in size and general habitus but may be separated by the short terminal antennal joint in worker and female.

Apterostigma immobile, sp. nov.

Worker. — Length 4.2-4.5 mm., of thorax (including epinotum) 2.1-2.2 mm. Head, excluding mandibles, fully one-third longer than broad back of eyes, prolonged into a distinct neck with reflexed margin, sides in front of eyes subparallel, in back of eyes converging gently to occiput, eyes strongly convex, situated posterior to middle of head and distinctly farther from mandibular insertions than their diameters, anterior clypeal margin truncate, frontal lobes moderately large, rounded and reflexed, continued backwards as high, distinct frontal carinae to the occiput, antennal scrobes bordered laterally by carinae medial to eye which are prolonged back of eye, short paired carinae of the mid-occipital region distinct, antennal scapes long and surpassing occiput

by more than their distal diameters, funicular joints 1 and 2 longer than broad, 3 and 4 about as broad as long, 5-9 broader than long, mandibles with about 11 small teeth. Dorsum of thorax with a broad pair of distinct carinae bordered laterally on the pronotum by somewhat carinate low gibbositities, mesoepinotal impression with a short pair of distinct carinae followed posteriorly by a single median tooth, basal surface of epinotum feebly carinate on the sides. Petiole in profile angulate above, plane below, with a distinct ventro-median tooth. Postpetiole from above hexagonal but with almost evenly convex sides, nearly twice as broad as the dorsal part of the petiole. Sides of gaster markedly carinate. Legs long and slender.

Opaque, finely granulose, mandibles densely and finely striate.

Pilosity of abundant long, fine and acute hairs.

Dark grayish brown, appendages somewhat paler.

Male. — Length 4.2-4.5 mm., of thorax (including epinotum) 1.9-2.0 mm. Head, between anterior clypeal margin and posterior margin of ocelli, about one-half longer than broad between the eyes, head drawn out behind into a distinct neck with reflexed margin, eyes strongly convex, anterior clypeal margin feebly convex, frontal carinae auriculate, sub-vertical, mandibles edentate, triangular. Pronotum produced anteriorly as two short, rounded, transverse carinae, epinotum evenly convex in profile, anterior wing 4.2-4.4 mm. long.

Cotypes: twenty workers and twelve males constituting a colony taken June 22, 1938 on Barro Colorado Island by myself. No female was found in the nest. The nest consisted of a very friable fungus garden attached by mycelia to the underside of a log and was about 20 cm. long, 8 cm. wide and 6 or 7 cm. high. The workers were noteworthy in that they would remain immobile for a longer time than usual in *Apterostigma* when disturbed, then move quickly for a moment, only to again become immobile.

Three workers given to me by the collector, Dr. W. M. Wheeler, several years ago belong to this species. They were taken on the island 8-6-1924 (no. 810).

This species is close to *A. wasmanni* Forel and *auriculatum* Wheeler but may readily be separated by the median unpaired tooth in the mesoepinotal impression.

Trachymyrmex cornetzi Forel *gaton*, ssp. nov.

Worker. — Length 2.4-2.8 mm., of thorax (including epinotum) 1.3 mm. Head, excluding mandibles, as broad as long, occipital margin shallowly and smoothly impressed, occipital corners rounded and with small, acute tubercle of which a single one near the pronotum on either side is largest; sides convex, eyes moderately convex, situated distinctly farther from the mandibular insertions than their diameters, anterior clypeal margin convex, deeply notched medially, antennal scapes exceeding occipital corners by slightly more than their distal diameters, all funicular joints broader than long, frontal lobes projecting in the form of a right or slightly acute angle rounded apically, frontal carinae ending in front of occiput, antennal scrobe bordered laterally and medial to eye by a carina curving medially to a point at a level a little back of eye and disappearing before reaching the frontal carinae, mandibles with a large apical tooth, a smaller sub-apical tooth and six to eight minute and irregular teeth. Thorax and epinotum without distinct spines but with small and acute tubercles, pronotum medially with two pair of tubercles and laterally with a tuberculate gibbosity on each side, the usual posterior two pair of thoracic spines represented similarly by tuberculate gibbosities, basal surface of epinotum on either side with a row of two or three tubercles and terminating with a larger acute tubercle in place of the spine. Postpetiole from above squarish, tuberculate on sides. Postpetiole about two-thirds broader than the petiole, as broad or slightly broader than long, evenly rounded anteriorly, emarginate on posterior margin. Gaster carinate on sides, coarsely tuberculate. Legs moderately long and slender.

Opaque, finely granulose, mandibles densely striate.

Pilosity of pale brown hooked hairs on tubercles.

Light ferruginous, frons with a brown blotch.

Female. — Length 3.2 mm., of thorax (including epinotum) 1.5 mm. Similar to the worker with the usual sexual differences. The mandible has the apical and sub-apical tooth distinct and fine worn small teeth on the masticatory margin; it is similarly densely and finely striate. The antennal scapes extend to the occipital angles. The pronotum on either side bears a low, massive spine with several acute denticles. Epinotal spines are well-developed but short and acute. The postpetiole is three-fifths broader than the petiole and about

one-fourth times broader than long. Basal color ferruginous but with a distinct dark brown blotch on the frons, dark blotches on the clypeus and sides of head, the thorax, sides of gaster below the lateral carinae, and a dark streak on the mid-dorsal surface of the gaster.

Cotype workers: A series of workers taken from two nests, one on June 12, the other August 13, 1938 on Barro Colorado Island, Panama Canal Zone, by myself (Nos. 754, 1149). The ants had formed in the June nest a crater 6 cm. high and with single fungus garden at a depth of 7 cm. whose diameter was 5 cm. The fungus garden was bluish gray externally, yellowish-brown internally. The August nest was surmounted by a crater 25 mm. high and had a single fungus garden at a depth of 40 mm. which was 25 mm. wide and 35 mm. high, appearing similar to the June garden. Other ants of this form were taken at other times at widely separated places in the island.

Holotype female: Taken July 19, 1938 (No. 1006) by Mr. E. C. Williams, Jr. in connection with a study made of a giant *Anacardium excelsum* tree. No workers were found.

This subspecies differs from the typical form from Colombia and British Guiana and the var. *bivittatus* of Trinidad chiefly in having three distinct pairs of tubercles on the basal surface of the epinotum in addition to the spine separating the two epinotal surfaces. This spine is only slightly larger than the tubercle, while in the typical form this spine is distinct and much larger. The coloration is more uniformly ferruginous and the infuscation on the sides of the gaster ventral to the lateral carinae is lacking. It may be close to *T. uncifer* Santschi of Panama but this species is described as 3.8-4 mm. long with coarser tubercles, six tubercles on the epinotum in the figure, and has other distinct differences.

Trachymyrmex morganii, sp. nov.

Worker. — Length 1.9-2.0 mm. of thorax (including epinotum) 0.95-0.98 mm. Head, excluding mandibles, barely longer than broad, broadest back of eyes, occipital margin feebly impressed, the angles evenly rounded though tuberculate, sides convex, with a tubercle in front of eyes, eyes convex, situated slightly farther from the mandibular insertions than their diameters, frontal lobes small, in the form of a rounded right angle, frontal carinae feeble and disappearing in front of occiput, antennal scrobe bordered laterally by a carina median to eyes which disappears at a level just beyond the

posterior eye margin, antennal scapes distinctly exceeding occipital corners, funicular joints 2-8 as broad as long, back of head on either side of pronotum with one tubercle larger and more massive than the other small tubercles of occiput, mandibles with two distinct apical teeth and four or five indistinct denticles. Thorax with three pairs of low gibbosities bearing irregular tubercles, pronotum medially with a pair of widely-spaced acute tubercles, a single tubercle rising from each of the third pair of gibbosities which are the highest on the thorax. Basal surface of epinotum on each side anteriorly with a pair of tubercles which tend to become confluent at their bases, epinotal spines small but distinct. Petiole, excluding peduncle, broader than long. Postpetiole nearly three-fourths broader than petiole, a trifle broader than long, anterior margin convex, posterior margin slightly concave and feebly bituberculate. Gaster feebly carinate laterally. Legs moderately long and slender.

Opaque, finely granulose, sparsely pruinose, mandibles finely and densely striate-punctate.

Pilosity of sparse, yellow, hooked hairs arising from tubercles.

Dull ferruginous, frons with an indistinct brownish blotch, mandibles infuscated on the margins.

Cotypes: Several workers taken June 14 and June 22, 1938 on Barro Colorado Island, Panama Canal Zone, by myself. The June 22 workers had erected a turret 21 mm. high of fine grains of clay on a steep slope. The turret, 11 mm. in diameter, leaned downward at an angle of about 10°. An opening 4 mm. in diameter lead to the single fungus garden at a depth of 60 mm. in the soil. The lens-shaped chamber was about 30 mm. high by 20 mm. wide. Inside was a fungus garden suspended on rootlets which was noteworthy in that the bromatia were unusually compact, suggesting those grown by *Cyphomyrmex rimosus*.

A single worker taken July 9 by Mr. E. C. Williams, Jr. (No. 1341) on the island in connection with a study made of a giant *Anacardium excelsum* tree belongs to this species.

This species is dedicated to Henry Morgan, the buccaneer who sacked Old Panama.

Trachymyrmex zeteki, sp. nov.

Worker. — Length 4 mm. of thorax (including epi-

notum) 2 mm. Head, excluding mandibles, squarish, nearly one-tenth longer than broad back of eyes, occipital margin with a moderately shallow and rounded median impression, occipital spines low, massive, rounded and feebly tuberculate, sides of head with a distinct post-ocular spine, eyes moderately convex, situated dorso-laterally a distance nearly equal to their diameters from the mandibular insertions, anterior clypeal margin convex with a broad medial notch, frontal lobes evenly convex except for a minute tooth on the antero-lateral border, frontal carinae distinct and extending to the occiput, antennal scrobes bordered laterally by a distinct carina medial to eyes extending to the occipital angles, mandibles feebly sinuate on outer margin, with two large apical teeth, the terminal tooth much the larger, and about eight small teeth on the masticatory margin, antennal scapes slender, extending a trifle past the occipital spines, all funicular joints distinctly longer than broad. Pronotum medially with a single distinct tubercle prolonged at either side apically into a denticle and laterally with a high, acute spine which is the longest of the thorax, the following two pair of thoracic spines progressively lower, of which the first pair is massive, the rear pair much smaller, compressed and tuberculate, declivous surface of thorax with a tubercle on each side. Basal surface of epinotum on each side with two or three tubercles, epinotal spines long, slender and acute. Petiole in side view two-fifths longer than high, with nearly plane ventrum and convex dorsum, from above and excluding the short peduncle, distinctly longer than broad. Postpetiole from above slightly over one-third broader than long, the sides convex and tuberculate, the posterior margin straight. Gaster strongly carinate laterally and with a much feebler pair of carinae mid-dorsally. Legs moderately long and slender.

Opaque, finely granulose, mandibles finely striate-punctate.

Pilosity of short, coarse, dark gray hairs which are borne dorsally on tubercles of variable size, coarsest on the gaster, and are mostly curved.

Ferruginous.

Cotypes: A small series of workers taken June 13, 1938 on Barro Colorado Island, Panama Canal Zone, by myself. The nest was in the slope of a hill back of the island laboratory in dense shade and was accidentally unearthed in digging a hole. The single chamber was about 67 mm. down in

the soil and was horizontally elliptical, 42×80 mm. The fungus garden was of typical attine appearance.

This species differs from the description of *T. squamulifer* Emery chiefly in having ten or more mandibular teeth instead of eight or nine, in having shorter antennal scapes, and in the nature of the occipital angles. It is close to *T. balboai* sp. nov. but is distinctly smaller, paler, and the proportions of the thoracic spines are different.

The species is dedicated to Mr. James Zetek who has taken such conscientious care of this splendid island biological reserve.

Trachymyrmex balboai, sp. nov.

Worker. — Length 4.3 mm., of thorax, including epinotum 2.1-2.2 mm. Head, excluding mandibles, as broad as long, occipital margin impressed with a broad, rounded impression, occipital angles in form of a low, massive and rounded spine with small tuberculations, sides convex, post-ocular tubercle, eyes in front view moderately convex and situated a little farther from the mandibular insertions than their diameters, anterior clypeal margin convex with a broad, very shallow, medial impression; frontal lobes convex with an antero-laterally projecting small tooth, frontal carinae feeble, gradually disappearing posteriorly on front of occipital angles; antennal scrobes bordered laterally medial to eyes by a slight carina which disappears posteriorly like the frontal carinae in front of the occipital angles; mandibles with about eight teeth, the apical two being much the largest, antennal scapes extending to apices of occipital angles, all funicular joints longer than broad. Pronotum medially with a large tubercle bifurcated apically, lateral pronotal spines long, slender, acute, a second thoracic pair of spines shorter, with massive bases, third pair of spines shortest, compressed, tuberculate, declivous surface of thorax with a small tubercle on either side; basal surface of epinotum with two or three small tubercles, epinotal spines long and acute. Petiole in side view one-half longer than high, from above, excluding a tapering pedicel, slightly longer than broad, the sides strongly tuberculate. Postpetiole from above nearly one-fourth broader than long, sides somewhat rounded and tuberculate, posterior margin straight. Gaster strongly carinate on sides, with a broad, shallow medial impression dorsally. Legs moderately long and slender.

Opaque, finely granulose. Gaster above with setigerous

tubercles tending to be connected by slight carinae. Mandibles finely striate-punctate.

Pilosity of coarse, short black hairs which are mostly curved to hooked.

Dark ferruginous, mandibles brown.

Cotypes: A few workers from a colony taken June 13, 1938 on Barro Colorado Island, Panama Canal Zone by myself. The ants were excavating soil from their nest on a steep hillside and were carrying out pellets of clay about one and one-half times the bulk of their heads.

This species differs from the description of *T. squamulifer* Emery chiefly in having shorter antennal scapes and in the nature of the occipital angles. The numerous whitish scales of *squamulifer* are absent on these specimens. It is distinctly larger than *T. zetekii*, has fewer mandibular teeth, feebler carinae of the head and has different thoracic spinulation.

A new guest ant

Megalomgremex (Cepobroticus) wheeleri, sp. nov.

(Figs. 15, 16)

Worker. — Length 2.2-2.3 mm., of thorax (including epinotum) 1.0 mm. Head, excluding mandibles, about one-fourth longer than wide back of eyes, occipital margin very faintly impressed medially, corners evenly convex, sides convex, eyes moderately convex, situated a distance from the occipital margin equal to their diameters, anterior clypeal margin convex, antennal scapes a little longer than the entire head length exclusive of mandibles, funicular joints 2-8 squarish, about as broad as long, terminal joint a trifle shorter than the three preceding joints taken together, mandibles triangular with 9-10 teeth, the teeth on the masticatory margin being of irregular development, the two apical teeth being distinctly larger. Promesonotum in profile evenly convex, meso-epinotal impression broad, deep and evenly rounded, epinotum convex, the basal surface somewhat flattened, posterior angles of epinotum with a high lamina on either side between which, on the declivous surface appears a circular, sunken impression. From above a pro-mesonotal impression is distinct on either side, the pronotum being appreciably the broader, meso-epi-

notal region grooved on either side. Petiole pedunculate, with a high convex node whose anterior face is evenly descending and whose posterior face is convex apically. Postpetiole in profile evenly convex above, distinctly lower than the petiolar node, convex anteriorly, feebly transversely rugulose and slightly concave behind. Gaster ovate. Legs long and slender.

With a metallic luster, smooth and shining; mandibles with sparse, setigerous punctations, feebly rugulose in front of eyes and in meso-epinotal region.

Pilosity of sparse, long, fine, acute and yellowish hairs.

Dark brown, appendages paler brown, becoming yellowish brown apically.

Female. — Length 2.8-3.2 mm., of thorax (including epinotum 1.2-1.3 mm. Similar to the worker with the usual differences. Head, excluding mandibles, slightly less than one-fourth broader than long, eyes situated a distance closer to the occipital margin than their diameters, lateral ocelli closer to the apical ocellus than to each other, anterior clypeal margin evenly convex, antennal scapes longer than the length of head, exclusive of mandibles, mandibles 10-11-toothed, only the two apical teeth being large and of consistent development. Epinotum evenly and feebly convex in profile; petiole pedunculate with a high node evenly rounded apically and smoothly descending anteriorly; postpetiolar node lower than the petiole, convex anteriorly, posterior face slightly excavated.

Described from a dealate female from one *Cyphomyrmex costatus* Mann nest and a female and worker, part of a small colony, from another nest. Both were taken August 15, 1938 on Barro Colorado Island, Panama Canal Zone, by myself. A much larger colony which I found August 13 consisted of 55 workers and three dealate females in a nest containing 35 workers and one dealate female *Cyphomyrmex costatus*. These, a single female and another colony, all from *C. costatus* nests, were living in symbiosis with the fungus-grower like *Megalomyrmex symmetochus* which was discovered by Dr. W. M. Wheeler living with *Sericomyrmex amabilis*.

The species is dedicated to Vasco de Balboa, discoverer of the Pacific Ocean, who passed through this region on his journey of discovery.

This species is the smallest member of the genus. It resembles *M. (C.) symmetochus* Wheeler in having stout antennae but is smaller, has a less flattened basal epinotal surface, smooth instead of striate mandibles, sparser pilosity and much darker color, in addition to other differences. The large colony of 55 workers is much paler than the others but is darker than *symmetochus*. Both workers and females are slightly larger than the castes of the darker form. Figure 15 is of a worker from the pale colony, Figure 16 of a female from the darker, smaller colony. The species is evidently somewhat polymorphic.

Contribuição ao estudo dos flebótomos de São Paulo. Dipt. 1.^a Nota.¹

por A. L. AYROZA GALVÃO & J. O. COUTINHO

da Faculdade de Medicina da Universidade de S. Paulo, Departamento de Parasitologia (Diretor: Prof. S. B. Pessôa)

e do Instituto de Higiene de S. Paulo (Diretor: Prof. G. H. de Paula Souza)

(Com 22 figuras no texto e 2 estampas)

Recebemos do Prof. S. B. Pessôa a incumbência de estudar os flebótomos dos focos de leishmaniose do Estado de São Paulo, ora objeto de pesquisas epidemiológicas sob sua orientação. Estes estudos entomológicos têm como finalidade principal e imediata o seguinte:

- 1) Determinação das espécies existentes nas várias regiões do Estado;
- 2) Variação estacional destas espécies;
- 3) Variação das espécies segundo as preferências alimentares;
- 4) Determinação precisa do material capturado em larga escala nêstes focos para a pesquisa de possíveis exemplares naturalmente infectados com as formas flageladas da *Leishmania brasiliensis*.

O material capturado em Vila Queiroz, pessoalmente pelo Prof. S. B. Pessôa e pelos auxiliares técnicos da Comissão é enviado ao laboratório fixado em liquido de Carnoy. Este fixador alem de seu conhecido emprêgo para as

1) Este trabalho é uma contribuição ao volume extraordinario da Revista de Entomologia, publicado em homenagem ao dr. Arthur Neiva, por ocasião do seu 60.^o aniversario natalicio. O trabalho foi executado sob os auspicios da Comissão de Estudos de Leishmaniose do Departamento de Saúde de São Paulo.